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AIR COMMAND AND STAFF COLLEGE

STUDENT REPORT

UNDERGRADUATE SPACE TRAINING:
A REVIEW OF THE PROPOSED CURRICULUM

MAJOR ROBERT D. VENTO, JR. 86-2595

"insights into tomorrow"

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Formal military training for AFSC 20XX, Space Operations Utilization Field, has been a hit or miss operation until late 1985. Upon its activation, AFSPACECOM became the source manager and predominant "user" of 20XXs. As part of this responsibility AFSPACECOM, with the assistance of ATC, began rebuilding and consolidating the 20XX training program. Undergraduate Space Training (UST), the initial step in the formal (Category 1) 20XX training process becomes a reality in 1986. As part of the building process, and in keeping with ISD methods, this report provides initial "user" feedback on the proposed academic subject listing contained in the draft ATC/AFSPACECOM UST/CTS. The "users" in this case are the AFSPACECOM field units that employ the 20XX resource. This report provides "users" the opportunity to "tweak" or adjust t.. proposed UST/CTS before it is used for the first time. The feedback is consolidated in this report for ATC and AFSPACECOM to use before starting the course.

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PREFACE

The author prepared this research report to provide Undergraduate Space Training/Course Training Standard (UST/CTS) feedback from operational AFSPACECOM units to the curriculum developers at AFSPACECOM, before the curriculum is initially used. This "field expert" review of the academics can lead to an improved initial product and ultimately a more effectively trained 20XX resource.

The author would like to express his appreciation to Major Robert Ewell, AFSPACECOM/DOTF, for sponsoring this project and to Dr Glenward Spivey, ACSC/CAE, for his support, advice, and assistance. Additionally, the author thanks the members of the 7th Missile Warning Squadron, Beale AFB CA, the 1000th Satellite Operations Group, Offutt AFB NE, and the Combined Space Operations Center (CSOC) Test Directorate, Falcon AFS CO for their time and efforts in this curriculum review.

ABOUT THE AUTHOR

Major Robert D. Vento, Jr. was commissioned in August 1973 upon graduation from the University of Alabama. He attended the Weapons Controller Basic Curse at Tyndall AFB FL and was then assigned to the Range Control Detachment, White Sands Missile Range, Holloman AFB NM. In December 1975, Maj Vento was assigned to Murphy Dome AFS AK where he was Director of Operations Training for the 744 ACWS NORAD Control Center. His next tour of duty was as a Squadron Senior Director and Executive Officer for the 603 TCS, Sembach AB FRG. After a year at the squadron, he was reassigned as Chief, Current Operations 601 TCG, Kapaun AS FRG. In 1979, Maj Vento moved to HQ TAC, where he was Chief of AWACS Plans and a primary member of the COMTAC/AFRED/AFLANT Contingency Support Staff.

In 1982, Maj Vento joined the faculty of Squadron Officer School. After serving as a section commander for five classes, he became Chief of the Programs Branch and one of the two resident course schedulers.

During his career, Maj Vento also attended the Air Force's Interceptor Weapons School for tactical control training using Dissimilar Aerial Combat Tactics (DACT). Additionally, he is a graduate of Squadron Officer School and a Distinguished Graduate of the Air Weapons Director Staff Officer Course.

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REPORT NUMBER 86-2595

AUTHOR(S) MAJOR ROBERT D. VENTO, JR., USAF

TITLE UNDERGRADUATE SPACE TRAINING: A REVIEW OF THE PROPOSED CURRICULUM

I. Purpose: To provide feedback to curriculum developers on the proposed UST curriculum.

II. Background: Formal military training for AFSC 20XX, Space Operations Utilization Field, has been a hit or miss operation until late 1985. Upon its activation, AFSPACECOM became the source manager and predominant employer of 20XXs. As part of this responsibility AFSPACECOM, with the assistance of ATC, began rebuilding and consolidating the 20XX training program. Undergraduate Space Training (UST), the initial step in the formal (Category I) 20XX training process becomes a reality in 1986. As part of the building process, this report provides initial "user" feedback on the proposed academic subject listing contained in the draft ATC/AFSPACECOM UST Course Training Standard. The "users" in this report represent a mission cross-section of operational AFSPACECOM units that employ the 20XX resource.

III. Methodology: Each of the three units supporting this effort received a copy of the draft UST Concept of Training Operations along with the proposed course training standard (Chapters 1-3 of this report). Each unit returned their feedback for inclusion in Chapter 5.

CONTINUED

IV. Recommendations: For the most part, each unit was satisfied with the initial effort and from their parochial mission standpoints suggested the necessary changes to improve the draft syllabus. In addition, the author suggests incorporating an Air Force Occupational Analysis into future development efforts to assist in standardizing and documenting mission oriented initial training. The analysis could provide the necessary links between the various mission areas and the officer/enlisted training/career development requirements.

CHAPTER ONE

INTRODUCTION

Establishment of the Air Force Space Command (AFSPACECOM) on 1 September 1982, marked a crucial milestone in the evolution of military space operations. This new command gives the Air Force an organization to both address the many challenges and to take advantage of the limitless opportunities that space affords the military (1:23). One of the major challenges is that of space education. In the future, the biggest limiting factor could be the lack of skilled personnel in the space career field. As a priority task, Air Force Space Command is consolidating and overseeing space training and career development (1:26). Prior to 1982, the Space Operations Utilization Field (AFSC 20XX) was fragmented into several operational, developmental, or test and evaluation units under many different commands (e.g. SAC, AFSC, NORAD, etc.). Although a 20XX career progression guide complete with specified or desired training does exist in AFR 36-23, Officer Career Development, this training was actually being conducted by ATC initially and each user command and unit specifically (10,--). Moreover, there was no single responsible agency overseeing training standardization, changing requirements, or specific unit training needs. Air Force Space Command assumed these responsibilities as it gained administrative and operational command and control over the many and varied operational, developmental, and test and evaluation units (4,--).

Beginning in June of 1985, Air Force Space Command hosted a series of meetings consisting of representatives from Air Training Command, Air Force Systems Command , and the Lowry Technical Training Center. As part of their charter, they began the process of redefining and jointly designing a fresh end-to-end space operations training program that will serve the Air Force well into the future (4,--). Using established policies and procedures for conduct of USAF formal training and education found in AFR 50-5, USAF Formal Schools, the new training program falls into two categories. Additionally, this program is patterned along the same lines that pilot and navigator training follow. Specifically, all new AFSC 20XX officers will begin training in the Under-

graduate Space Training (UST) program conducted by ATC. Following graduation from UST, space operators will attend a Combat Crew Training Squadron (CCTS) course conducted by AFSPACECOM. When they finish their system-specific CCTS, the graduates will receive their duty AFSC and be ready for assignment to unit level operations. Subsequent unit assignments may require the officer to attend CCTS again for further system training into a different area of space operations (4,--).

Once the Joint Task Force Review Group decided on a plan of attack for space operations training, they drafted a Course Training Standard (CTS) which lists academic subjects proposed for UST. The CTS is designed to allow UST to correct the limiting factors identified by ATC and AFSPACECOM in existing training courses. Moreover, it should include many necessary subjects currently not taught in existing space operations training courses.

As AFSPACECOM and ATC develop the UST curriculum, one critical factor in this development will be feedback. As with any training and education program developed using AFM 50-2, Instructional Systems Development, and AFP 50-58, Handbook for Designers of Instructional Systems, feedback is the "glue" that holds the ISD process together. Feedback assists the curriculum managers to develop a current, mission-oriented, and above all else, useful course to the Air Force (5,--). Also, feedback should occur within and between each of the five ISD steps in course development.

PURPOSE

This research report focuses on the draft Course Training Standard (CTS) academic subject listing for UST and serves as a feedback vehicle between the end unit 20XX "users" and the curriculum developers. Specifically, this report documents UST/CTS feedback solicited from a mission cross section of operational AFSPACECOM units while the UST/CTS is still in draft form. As such, it will provide AFSPACECOM and ATC with "field expert" ideas for improving the draft UST/CTS.

OBJECTIVES

To accomplish the feedback purpose of this report, the following four objectives must be met:

1. Determine the Concept of Operations Training for the AFSC 20XX Space Operations Utilization Field and how UST fits into this plan. This concept is developed by briefly stating existing training shortfalls, then contrasting the proposed ideas to overcome the training shortfalls. Finally, a description of where UST fits into the total training picture completes the groundwork information for the UST/CTS feedback process to begin.

2. Determine the UST curriculum topics. The UST/CTS contains the four proposed subject areas ATC will use. These topics form the basis for the feedback from the "field experts" ("users" of the 20XX resource) to the curriculum developers.

3. Validate proposed UST curriculum topics. The three individuals/agencies selected to review the syllabus represent a sample cross-section of the operational units that employ 20XXs.

4. Consolidate "user" recommendations for further curriculum refinement. The recommendations represent all the feedback comments from the group of 20XX "users."

LIMITATIONS

Several limitations were placed on this report. First, the material used to conduct the UST/CTS review is all in draft form, and not yet officially approved as the joint ATC/AFSPACECOM final working plan. This fact lends substantial importance to the timeliness and content of the feedback for developing an improved initial product. It also assumes a valid needs assessment exists.

Second, the small sample size of the users surveyed, and the specific users themselves, constitutes a conscious decision made by the sponsor in conjunction with the author. Of the 1164 20XX manpower positions projected for 1FY89 within AFSPACECOM, 83% will be employed in the mission areas selected by the sponsor for the feedback (10,--).

Finally, this report does not provide a definitive right or wrong curriculum for UST, but will provide the UST curriculum developers/managers with feedback from "field experts" and "users" of the planned or desired end product of UST - a properly trained 20XX resource.

CHAPTER TWO

CONCEPT OF SPACE OPERATIONS TRAINING

PREVIOUS DEFICIENCIES

When Air Force Space Command assumed central responsibility for all space operations training, several shortfalls accompanied this change. First and foremost was the absence of MAJCOM guidance for managing the training of 20XX personnel. AFSPACECOM did not possess a centralized command crew training capability, dedicated crew training facilities, or a system acquisition infrastructure necessary to procure the required integrated training systems (10,--).

Additionally, AFSPACECOM inherited several training programs where traditional Air Force training program standards had not been applied uniformly. For example, ATC was conducting six different basic courses and eight different supplemental courses at Lowry AFB, in addition to two orientation courses at Peterson AFB. All of this training was conducted without the benefit of dedicated training equipment. Essentially, ATC was conducting all training for only a portion of the total space operations mission. Training for other portions of the mission such as Space Shuttle operations was being conducted by Air Force Systems Command in their CADRE training programs. These CADRE programs primarily consist of contractor training on specific systems with no crossflow of information or training across the entire career field; essentially a compartmentalized training system with no central career field training management (10,--).

SOLUTION

Beginning in June of 1985, the ATC/AFSPACECOM/AFSC Joint Task Force Review initiated and realigned 20XX training based on Air Force policy contained in AFR 50-5 and current ATC examples. AFR 50-5 establishes policies and procedures for conduct of formal training and education. USAF formal courses fall in two broad categories.

Category I

Category I training has general application throughout the Air Force and serves the needs of many different types of units or organizations. It involves training or education of individuals in formal courses conducted by organizations whose primary mission is training and education (e.g. Air University, Air Training Command) (3:1-1).

Category II

Category II training is conducted by MAJCOMs and their operational units. These activities are incidental to the unit or MAJCOM - primarily combat or combat support missions. These include Combat Crew Training Squadrons (CCTS), aircrews transition training, weapons controller training, and certain types of specialized technical qualification training (3:1-1).

In addition to the policy definition of Category I and II training, AFR 50-5 reminds MAJCOMs not to duplicate existing Category I courses, and to examine all new courses for potential Category I training status. Using this standard guidance, ATC and AFSPACECOM redefined their roles and responsibilities. Also ATC's Undergraduate Pilot Training and Undergraduate Navigator Training (UPT/UNT), with their MAJCOM unique CCTSs or Replacement Training Units (RTUs), provided organizational examples of existing programs (4,--).

THE TRAINING CONCEPT

Undergraduate Space Training (UST)

The purpose of UST is to provide broad-based space operations knowledge which will serve as a foundation for space operators career development. The course will concentrate on fundamentals and will have the single purpose to train a space operations officer who can cross-flow among sensors, warning centers, satellite or shuttle operations, and related staff duties (9,--).

A major feature of UST will be the use of simulators to train and evaluate trainees on basic operations of sensors, operations centers, and satellite operations. Similar to the T-37s, T-38s, and simulators ATC uses to train pilots, UST (and its simulators) will concentrate on the fundamentals of the military use of space. For example, UPT trains

"universal" pilots skilled in the fundamentals of military airmanship. When pilot trainees complete UPT, they are then ready to build on their basic airmanship skills in specific tactical or strategic weapon systems (e.g. F-15, F-16, C-141, B-52, KC-135, etc.). As such, UPT provides the basic aptitudes necessary to fly, and then the gaining commands proceed from there. Like UPT, UST will provide a "universal" space operations officer with the skills necessary for further system specific training at the AFSPACECOM Combat Crew Training Squadron. UST simulators will provide generic "hands-on" training functionally similar to ATC T-37/T-38 training flights. The simulators will also be used for evaluation to ensure that trainees can execute the kinds of procedures necessary to function successfully in the space operations environment (9,--;2:51).

Persons satisfactorily completing UST will be awarded entry-level AFSCs in the space operations career field and the space badge. In addition to training USAF personnel, UST will conduct supplemental space operations training for other services and DOD agencies using modular blocks of instruction (9,--). ATC will be responsible for conducting all Category I UST.

<u>Combat Crew Training Squadron (CCTS)</u>

The purpose of the CCTS is to provide formal training to support all units assigned to AFSPACECOM. The CCTS will provide position-qualified procedural training including command and control centers, space and missile warning sensors, satellite operations, manned space flight control operations, and all future assigned missions. The CCTS will prepare students for mission-ready/position-qualified status upon graduation. Graduates will be ready to complete unit level local procedure training leading to position certification (9,--).

AFSPACECOM will be responsible for conducting all Category II CCTS operations. In this category, they are carrying out a function similar to SAC's B-52 and KC-135 CCTS, or TAC's F-15/16 RTUs.

As of October 1985, UST will operate from Lowry AFB CO and CCTS will operate from facilities at Peterson AFB and Falcon AFS, CO. With the assistance of the Air Staff, AFSC, and ATC; AFSPACECOM will be able to exploit the economies and efficiencies of combined acquisition strategy by jointly defining state-of-the-art training equipment for CCTS and

UST (10,--). These actions will assist AFSPACECOM in overcoming the systems acquisition limitations faced when it assumed overall responsibilities for space operations and training.

CHAPTER THREE

UST COURSE TRAINING SYLLABUS

As of 15 November 1985 the Joint Task Force Review Group had assembled a draft listing of the academic subjects recommended for the Undergraduate Space Training/Course Training Standard (UST/CTS). These subjects, listed in the ATC/AFSPACECOM Joint Plan for Training Development, fall into four categories. These categories are Space Background, Space Fundamentals, Space Systems, and Applications.

UST/CTS ACADEMIC SUBJECT LIST

I. Space Background

The Space Background phase contains nine distinct blocks of academic subjects.

A. Terms of Reference

1. Space
2. Environment
3. Definitions for Limits of Space
   a. Propulsion
   b. Legal
   c. Aerodynamics
   d. Life Support
   e. Operational
4. Space System
   a. Space Segment
   b. Spacecraft
   c. Launch System
   d. Space Ground Segment
   e. Space C2 Segment
5. Ground Sensor System
   a. Sensor
   b. Processor
   c. Communications/Control Segment

B. History

1. Pre-WW II
2. WW II
3. Post-WW II (50's)
4. 60s
5. 70s
6. 80s

C. Law

1. International Law
2. Treaties (Ratified and Unratified)/Protocols and Conventions
3. UN Resolutions

D. Policy and Doctrine

E. Organizations

1. Basic DOD Organization
2. Mission/Responsibilities/Relationships

DIA	AFSC	AFSPACECOM
CIA	JSC	USSPACECOM
DMA	FTD	NAVSPACECOM
DNA	AMES	ARSPACECOM
DOT	JPL	JEWC
NASA	Lincoln Lab	AFTAC
Agriculture	APL	AFOTEC
Weather	DARPA	NCA
TENCAP	NORAD/ADCOM	IC
		DCA

3. US/USSR Organization Comparisons

F. Computers

1. History
   a. 1st Generation: Vacuum Tubes
   b. 2nd Generation: Transistors
   c. 3rd Generation: Integrated Circuits
   d. 4th Generation: Large Scale Integrated Circuits
2. Hardware
   a. Central Processing Unit
   b. Main Memory
   c. Auxilliary Memory (Disc, Tape)
   d. Input/Output Devices
   e. Data Communications
      (1) Types
         (a) Synchronous
         (b) Asynchronous
      (2) Equipment
3. Software
   a. Languages
   b. Types of programs
4. Future

G. System Acquisition

1. Requirement Process
   a. SON
   b. Milestones
2. PPBS
   a. AFSPACECOM Process
   b. USAF Process
   c. OSD Process
3. Acquisition Methods
   a. Major Force Programs
4. AFSPACECOM Role in Acquisition Process
   a. 3400 Funding

H. AFSPACECOM Contractor Operations

1. Reasons for Contractor Operations
2. Contract law
3. Contractor Responsibilities
4. Air Force Quality Assurance Evaluation

I. Officer Development

1. Promotion Opportunities
2. Career Plan/Ladder
3. Career PME/Civilian Education
4. Career Broadening
5. Physical Training
6. Officer Qualities Enchancement
7. Moral Leadership

II. Space Fundamentals

The Space Fundamentals phase contains nine distinct blocks of academic subjects.

A. Astronomy

1. Basic Fundamentals

B. Space Environment

1. Background Physics
   a. Atomic Structure
      (1) Absorption, Emission, Temperature
   b. Electromagnetic Radiation
      (1) Wave, Flux
   c. Radiation
      (1) Black Body, Spectral Analysis

d. Plasma Physics
   (1) Single Particle Motion
   (2) Plasma Frequency Effects
e. Characteristics of Telescopes
   (1) Optical
   (2) Radio

2. The Sun
   a. Quiet Sun
      (1) Internal Structure
      (2) Solar Atmosphere
      (3) Surface Features
   b. Active Sun
      (1) Sun Spots
      (2) Solar Cycle
      (3) Solar Flares
3. Interplanetary Medium
   a. Solar Wind
   b. Interplanetary Magnetic Field
   c. Effects of Flares
   d. Interplanetary Spacecraft
4. Magnetosphere
   a. Structure
   b. Trapped Radiation Belts
   c. Earth's Geomagnetic Field
   d. Geomagnetic Disturbances
      (1) Storm Phases
      (2) Magnetic Storms
   e. Geomagnetic Activities Indices
   f. Aurora
5. Ionosphere
   a. Formation
   b. Climatology
   c. Height Regions
   d. Radiowave Propagation
6. Air Weather Service Forecasts
   a. Products
   b. Limitations

C. <u>Orbital Mechanics</u>

1. Keplerian Orbital Elements
   a. Semi-major Axis
   b. Eccentricity
   c. Inclination
   d. Right Ascension
   e. Argument of Perigee
   f. Epoch Time
2. Orbital Phases
   a. Launch
   b. Ascent and Orbit Injection
   c. On-orbit Operation
   d. Re-entry

3. Functional Orbits
   a. Orbit Types
      (1) Prograde/Retrograde
      (2) Interplanetary Trajectory
      (3) Ballistic Trajectory
   b. Synchronous
      (1) Sun Synchronous
      (2) Geosynchronous
      (3) Semi-synchronous
      (4) Super-synchronous
   c. Molniya Type
   d. Polar
   e. Constellations
   f. Maneuvers
   g. Rendezvous
4. Perturbations
   a. 2nd Body Effects
   b. 3rd Body Effects
   c. Solar Winds
   d. Drag
   e. Gravitational Pull
   f. Solar Flares/Flux
5. Perturbation Effects
   a. Decay
   b. Low Altitude
   c. High Altitude
   d. Zero Inclination
   e. Sun Synchronous
   f. Polar
   g. Drift Rates
   h. Revisit Time - Repeat Coverage
6. Orbital parameters vs Ground Traces
   a. Effect of Geomagnetic Field
   b. Boost/Deboost Rates
   c. Walk Rate
   d. Speed Satellite Moves
      (1) Effect on Coverage

D. <u>Rocketry</u>

1. Basic Designs
   a. Staging
   b. Strap-ons
   c. Clustering
      (1) Advantages
      (2) Disadvantages
      (3) Materials
2. Propulsion System Design
   a. Thermal Engines

b. Electric Engines
   (1) Present and Future Systems
   (2) Advantages/Disadvantages

3. Fuel Types
   a. Liquid
      (1) Storable
      (2) Cryogenic
      (3) Monopropellants
      (4) Bi-propellants
      (5) Tri-propellants
   b. Solid
      (1) Heterogenous Charges
      (2) Homogenous Charges
   c. Core Designs
      (1) Progressive Thrust
      (2) Regressive Thrust
      (3) Stable Thrust
4. Guidance, Navigation, and Control
   a. Generic Logic Process
   b. Achieve Proper Insertion
   c. Achieve Orbit Maintenance/Change
   d. Achieve Altitude Control
   e. Achieve Recovery/Rendezvous
5. Launch Operations

E. <u>Spacecraft Subsystems</u>

1. Power Supplies/Electricity
2. Guidance
3. Maneuver/Station Keeping/Fuel
4. Platform
5. Antenna Systems
6. Communications
7. Mission Payload
8. Design/Materials Considerations
9. Weight Considerations
10. Stabilization/Altitude Control
11. Survivability/Hardening
12. Thermal Control
13. On-board Processor
14. Ordnance

F. <u>Sensor Technology</u>

1. Radar Theory
   a. Mechanical
   b. Phased Array
2. Optical
3. Electro-optical
4. Infrared
5. Radio-interferometry

G. TT & C

1. What is it?
2. TT & C Stream
3. Types of Links
   a. Up Channel
   b. Down Channel
   c. Ross Link/Relay
4. Uses of TT & C
   a. Payload Tasking
   b. Ephemerides
   c. Monitoring
   d. Health and Status

H. Communications

1. Communication Terms
2. Methods
   a. Satellite Communications
   b. Ground Communications
   c. Networks
   d. Battle Communications
3. Frequency Utilization
4. Interference
5. Modes and Communications
6. Basic Equipment
7. Products of Communication

I. Directed Energy

1. Term Definition
2. Types of Directed Energy
3. Basic Physics of Directed Energy
4. Methods of Propagation
5. Hindrances to Propagation
6. Technology

III. Space Systems

The Space Systems phase contains ten distinct blocks of academic subjects.

A. US Missile Warning/Space Surveillance Networks

1. Sensors
   a. Infrared
   b. Radar
   c. Electro-optical

2. Intelligence Community
    a. FSINT
    b. HUMINT
    c. SIGINT
    d. IMINT
    e. Collection Management
3. Networks
4. Events Processing

B. <u>USSR Space Surveillance/Missile Warning Networks</u>

1. Sensors
    a. Type
    b. Location
    c. Capabilities
2. Networks
3. Events Processing

C. <u>Specific US Systems</u>

1. Space Support
    a. Systems
    b. Ground Stations
    c. Launch Vehicles
    d. Launch Sites
    e. Recovery Sites
    f. Commercial Infrastructure
    g. Cost
    h. Launch Time Turn-around
    i. Pre-Launch Preparation
        (1) Time Lines
    j. Post-Launch Activities
        (1) Time Lines
2. Force Enhancement
    a. Communications
    b. Navigation
    c. Surveillance of Space
        (1) Surveillance from Space
            (a) Intelligence
            (b) SDI Sensors
        (2) Environmental
            (a) MC and G
        (3) Control Organizatons
            (a) AFSCF
            (b) CSOC
            (c) 1000 SOG
            (d) NASA
3. Space Control
    a. Strategy
    b. Purpose
        (1) Low Altitude Belts
        (2) High Altitude Belts

c. Offensive/Defensive
    (1) Deception
    (2) Cover
    (3) Weapons
        (a) SDI
        (b) ASAT
    (4) Weapons Employment Phase
    (5) Maneuver
    (6) Space Interdiction
d. Targeting
    (1) Definition
    (2) Target Identification
    (3) Space Order of Battle
    (4) Scenario-Dependence
    (5) Parameters
e. Observations
    (1) Sensor Data
    (2) Reports, SATRAN

4. Force Application from Space
    a. Treaty Implications/Policy Reviews
    b. Near Term Technology
    c. Future Technology
        (1) SDI
        (2) Kill Mechanism
        (3) Space-based Lasers
        (4) Charged Particle Beam
        (5) Free Electrons
        (6) Strategic Support to Tactical Operations
        (7) Kinetic Energy Weapons

D. <u>Soviet Space Program</u>

1. Soviet Doctrine and Policy
2. Use of Space
    a. Strategic Rocket Forces
    b. PVO Strany
3. Design Bureaus
    a. Manufacturing Capabilities
4. Launch Operations
5. Launch Facilities
6. Control Organization
7. Specific Systems
    a. Launch Systems
    b. Shuttle
8. Order of Battle
    a. Capability/Use
9. Missi s
10. Technology

E. Other Foreign Space Programs

1. Space Systems (Launch systems, technology base, missions, policy decisions)
   a. ESA
   b. Japan
   c. China
   d. FRG
   e. France
   f. Indonesia
2. Third World Satellite Buying Policy

F. Survivability of Space/Ground Systems

1. System Survivability Requirements
2. Threats
   a. Environment
   b. Attack
      (1) Space
      (2) Ground-based
3. Design Life
4. Redundancy
   a. Launch Planning
   b. Mission Planning
5. Vulnerability
   a. Vehicles
   b. Launch Sites
   c. Spacecraft
   d. Ground Station
   e. Ground-based Sensors
6. Countermeasures

G. Manned Systems

1. Manned vs Unmanned
   a. Advantages/Disadvantages
2. Shuttle Transportation System
   a. Mission
   b. System Description
   c. Operations Concepts
      (1) Ground Support
      (2) Launch Rate
      (3) Recovery
   d. Capabilities and Limitations
   e. Crew Positions
      (1) Astronaut
      (2) Mission Specialist
      (3) Payload Specialist

H. Commercial Space

1. Policy/Legal Review
2. Major Players
   a. Major Users/Missions
   b. Manufacturers
   c. R & D Firms
3. Contingency Plans to Support Wartime Capability
4. Exploiting Civil Sensors/Satellites

I. Battle Management

1. Requirements
   a. Negation
   b. Protection
   c. Informing
   d. Surveillance
   e. Targeting
   f. Execution
2. Soviet Systems
3. Organizations
4. War
   a. Limited Nuclear War
   b. Theater
   c. General
5. Access to Space
   a. Launch
   b. Communications
   c. Demonstrated Capabilities
   d. Compare with Soviets
6. Examples
   a. Afghanistan
   b. Grenada
   c. Mid-East
   d. Falklands
   e. Mayaguez
7. Service Applications (separate classes)
   a. Air Force
   b. Navy
   c. Army

J. Future Systems

1. Space Systems
2. On-orbit
3. Ground Support Systems
4. Technology Base
5. Space 2025
6. Trans-Atmospheric Vehicle
7. Orbital Transfer Vehicle
8. Lunar Station
9. Interplanatary Missions

10. Communications
11. Computers
12. Manufacturing in Space
13. Launch Systems
14. Weapons
    a. Protect/Negate
15. Space-based Surveillance
16. Extra Terrestrial Construction
17. Commercial Applications

IV. Applications

The Applications phase contains four distinct blocks of instruction application and evaluation.

A. Generic Sensor Simulator

1. Crew Changeover
    a. Current Operations Capability
    b. Current ECM
    c. Past/Upcoming Events
    d. Maintenance in Progress/Scheduled
    e. Current Alert Status
    f. System Anomalies
    g. Space Track Status
    h. Classified Material Inventory
    i. Current Site Status
2. System Status Checks
    a. Test Tape
    b. Console Configuration
3. Mission
    a. Current Log
    b. Monitor Mission Operations
    c. Coordinate with Higher Headquarters
    d. Complete Operations Report
    e. System Reporting
    f. Operations Capability
    g. ECM
    h. Emergencies (Security, Fire, etc)
    i. Space Track
    j. Space Alerts
    k. DEFCON/LERTCONS
    l. Adjacent Site Outages
4. Assumptions
    a. 40 hours academic prior to first mission
    b. 10 simulator missions (last one is checkride)

B. Generic Satellite Simulator

1. Daily Operations
   a. Crew Changeover
      (1) Supt Configuration
         (a) Satellite
         (b) Ground Station
      (2) Past/Upcoming Events
      (3) Maintenance in Progress/Scheduled
      (4) Operations Capability
      (5) RFI
      (6) System Anomalies
      (7) DEFCON/LERTCONS
      (8) RTS/CRS Status
      (9) Classified Inventory
   b. Conduct Shift Schedule
      (1) Pre-pass
      (2) Pass
      (3) Post-Pass
2. Operations Simulation
   a. Current Log
   b. Monitor Maintenance
   c. Coordinate with Higher Headquarters/RTSs/User
   d. Operations Reports
   e. Operations Capabilities
   f. RFI
   g. Emergencies
   h. DEFCON/LERTCONS
   i. Satellite Contact
      (1) Pre-pass
      (2) Pass
      (3) Post-Pass
   j. Anomalies/Contingencies
   k. Special Events
      (1) Delta V
      (2) Battery
      (3) Station Keeping
      (4) Eclipse
3. Special Simulation
   a. Pre-Launch
      (1) Command Validation
      (2) TLM Validation
      (3) Procedure Validation
   b. Launch
      (1) EODET
      (2) 1st Acquisition
      (3) Category II Test Plan
   c. Recovery Activities

4. Assumptions
   a. 80 hours academic prior to first mission
   b. 10 simulator missions (last one is checkride)
   c. Builds on knowledge from sensor simulator

C. <u>Combined Forces Exercises</u>

1. War Games Scenario

D. <u>Field Trips/Video Tapes</u>

1. Sensor Sites Operations
2. Satellite Control Center Operations
3. Command Center Operations

CHAPTER FOUR

UST/CTS FEEDBACK METHODOLOGY

The feedback process began by determining exactly whom the feedback should come from and how many inputs would be necessary to adequately review the draft UST/CTS product. The AFSPACECOM staff requested that the inputs come from a mission cross-section of space operations. They suggested using Satellite Operations, Sensor Operations, and Command Center Operations as representative areas. Since only 467, or roughly 40% of the 1164 manpower authorizations are currently filled, the sponsor and the author decided to direct this initial effort at feedback to the supervisory level (10,--). These "users" of the 20XX Space Operators resource are in a better position at this point in the CTS development process to provide a "big picture" look at the direction that centralized training is following. Further, the selected supervisors possess the operational background and experience necessary to project their suggestions into the context of what will be necessary for the entire career field, and not just a portion of the operational mission.

THE "USERS"

For the Sensor Operations input, a copy of the draft UST/CTS was sent to the 7th Missile Warning Squadron, Beale AFB CA. The 1000th Satellite Operations Group, Offutt AFB NE, received the Satellite Operations copy. The final copy was sent to the Consolidated Space Operations Center (CSOC) Test Directorate, Falcon AFS CO, for Command Center Operations review.

THE TASK

Each of the three targeted user groups received a 15 Nov 85 copy of the draft UST/CTS subject listing. They were asked to review the four parts of the UST/CTS for subject matter content, keeping in mind that UST will provide broad-based

space operations knowledge as a foundation for space operator career development. The questions asked were: (1) Are there any subjects missing that have 20XX career field- wide application? (2) Are there any subjects no longer required? (3) Are there any subjects that do not apply to th entire career field, even at the general knowledge level, that could be more efficiently or effectively taught at the CCTS or unit level? These three questions were used to begin the feedback process and purposely left "general" in wording so the "users" would have the latitude to provide honest and open feedback via this report to the curriculum developers. The targeted "users" were given more than six weeks to complete their review and return their inputs.

CHAPTER FIVE

UST/CTS USER FEEDBACK

This final chapter consolidates the comments received from the operational AFSPACECOM unit reviews of the UST/CTS academic subject list. As a consolidation, this chapter is formatted sequentially from the first phase, Space Background, to the last phase, Applications, to facilitate use by the AFSPACECOM training development staff. Paragraph reference numbering used in the feedback corresponds to the numbering sequence used in Chapter Three of this report. In the majority of cases, the user recommendations did not include rationale or justification. However, each comment area is referenced should the reader require further information. Finally, the author concludes the feedback chapter with a recommendation for AFSPACECOM to request an AFR 35-2 occupational analysis to further enhance the training development effort.

I. SPACE BACKGROUND

Reference paragraph A, Terms of Reference: training to the A knowledge scale level seems pretty superficial. Recommend training to a minimum B level, particularly since the terms are common to several tasks associated with the syllabus (7,--).

Reference paragraph D, Policy and Doctrine: recommend reducing training scale level from C to B (7,--).

Reference paragraph E, Organizations: recommend training to the B level. Also, due to recent changes, a discussion of the AFSCN would be more applicable than AFSCF/MSFSG with respect to mission, responsibilities and relationships of AFSPACECOM and AFSC (paragraph E, 2) (7,--).

Reference paragraph F, 2, e, (2): within the equipment subject list be sure to include FDMA and TDMA (7,--).

Reference paragraph G, System Acquisition: recommend increasing training to the B level. Additionally, include a

discussion of the role played by the Air Force Operational Testing and Evaluation Center (AFOTEC) in the requirements/PPBS process (7,--).

Reference paragraph I, Officer Development: add "8. Ethical Responsibilities" (7,--).

Add paragraph J:

J. Administrative/Operations Documents

1. Operational Requirements Documents (ORD)
2. Tactical Control Documents (TCD)
3. Operational Capability (OPSCAP) Reporting
4. DEFCON/LERTCONS
5. Mission Logs
6. Emergencies (Security, Fire, etc.) (7,--)

II. SPACE FUNDAMENTALS

Reference paragraph B, 6: topics do not seem parallel with the preceeding topics in paragraph B. Recommend addressing how these products are used (7,--).

III. SPACE SYSTEMS

Reference paragraph C, 2, c, (3): change AFSCF to AFSCN and include AFSPACECOM/USSPACECOM. Add "(e) Satellite Early Warning System" and "(f) 2nd Satellite Control Squadron (GPS/NDS)" (7,--).

Reference paragraph C, 3: add "f. Attack Warning/Attack Assessment" (7,--).

Reference paragraph E, Other Foreign Space Programs: recommend increasing training level from A to B (7,--).

Reference paragraph J, Future Systems: recommend increasing training level from A to B (7,--).

IV. APPLICATIONS

UST should address all topics in paragraph A 3, Mission, on a general functional level and the CCTS shou.' conduct the in-depth substance of the qualification training program. This would reduce total training time for each individual by

not duplicating instruction/evaluation between UST and CCTS (8,--).

Phase IV, Applications, should be part of the Combat Crew Training Squadron curriculum for the following reasons:

The CCTS will cover all the subtasks required to perform the primary tasks currently listed in this phase plus instill a certain amount of pressure to see if the student can perform as a combat crew member in a stressful environment. The training key is the individual's performance with a crew. Their ability to set priorities and take command and control of the Tactical Operations Room (TOR) identifies them as proficient (8,--).

The CCTS will be equipped with a complete TOR and a trained staff with recent hands-on experience (8,--).

Reference paragraphs A, 3 and B, 1, 2: applying crew coordination procedures, including Operational Requirements Documents (ORDs), Tactical Control Documents (TCDs) and Operational Capability (OPSCAP) reporting is necessary, but these subjects must be taught before they are applied. Recommend they be included in Phase I and ensure subjects such as DEFCON/LERTCONS and Emergencies are also covered. Instruction in the Applications phase should realistically be reteaching rather than breaking new ground (7,--).

Common concerns that could require additional attention in curriculum development are centered on duplication of training effort in the Applications phase. In order to stay within AFR 50-5 guidelines, AFSPACECOM must be sure there is no duplicate effort in simulator use for instructional/ evaluation purposes between UST and CCTS. Part of this concern could be centered on the acquisition and use of "generic" system simulators for UST and the specific system simulators for CCTS. As currently envisioned, the generic simulators will be used to apply and evaluate a 20XXs general knowledge and capability to function in the space operations environment. The system specific simulators CCTS will use are planned to train and evaluate a 20XX for a specific operational mission area. As long as these intentions remain separate there is no duplication of effort. Should any of the simulator equipment get cut from the program, AFSPACECOM would need to rethink the plan for training to best use both time and assets.

OCCUPATIONAL ANALYSIS RECOMMENDATION

AFR 35-2, Military Personnel: Occupational Analysis, states occupational surveys are designed to gather information about Air Force jobs for adjusting or establishing training programs, refining occupational structures and sustaining or modifying Air Force personnel programs. Occupational survey data are used for such things as: (1) structuring and organizing officer specialties into career areas, (2) maintaining current specialty and course training standards, and (3) validating and determining the content coverage of Career Development Courses (CDCs) and Specialty Knowledge Tests (SKTs) for enlisted personnel.

The author recommends an occupational survey be requested by AFSPACECOM for their AFSC 20XX Utilization Field. Given that one of AFSPACECOMs objectives is to ". . . assume responsibility for overseeing training standardization and career field management. . ." (4,--) for all 20XXs, use of an Air Force capability (through occupational surveys) to validate and standardize the proposed curriculum will be invaluable. This is particularly true since AFSPACECOM has assumed the responsibilities from several other commands. Using this system or "umbrella" approach should assist AFSPACECOM curriculum developers and personnel managers with consolidating and developing career training and progression for space operators. As a minimum, AF Occupational Surveys should be conducted following graduation of the first few classes from UST and CCTS. These field surveys could provide the specific feedback necessary to really gain the maximum economy and efficiency from UST and CCTS.

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